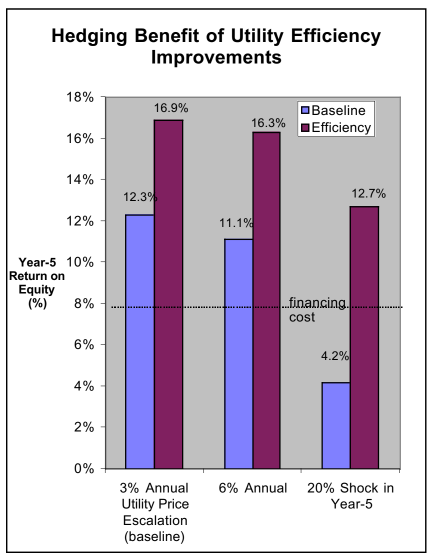
# AMPLIFYING REAL ESTATE VALUE THROUGH ENERGY & WATER MANAGEMENT

Evan Mills, Ph.D.
University of California
Lawrence Berkeley National Laboratory
Energy Analysis Department
MS 90-4000, Berkeley, CA 94720
(510) 486-6784
emills@lbl.gov
http://eetd.lbl.gov/emills

Draft of November 23, 2002

## SUMMARY

Over $80 billion is spent annually in the U.S. to provide energy to income properties, some paid by owners and some paid by tenants. Investments in energy- and water efficiency can increase the profitability of these real estate investments by raising the Net Operating Income (NOI), and hence returns during the holding period, and, ultimately, proceeds at time of sale. A case study identifies a potential one-time investment in utility efficiency upgrades of $0.95/sq. ft. (1.8% of the purchase price) resulting in reduced annual operating costs of $0.66/square foot (15% of NOI). This translates into an increased year-five return on equity (ROE, or "cash-on-cash" return) from 12% to 17%. This in turn corresponds to an increase in after-tax net present value (NPV, d=10%) of $29,000 (over a five-year holding period), and a bump in resale value of $36,000 to $46,000 (for CAP rates of 9% and 7%, respectively) – approximately 10-times the initial investment. The savings also equate to eight vacancy percentage points and a doubling in the project's "profitability ratio" (NPV divided by initial investment) from 0.7 to 1.4.




Investments in managing utility costs also provide a hedge against price increases. As an illustration, a sensitivity analysis of 6% annual utility price escalation—as opposed to the 3% baseline—dropped the year-5 ROE by about 1.2%-points, while a one-time 20% price shock in year-5 cut the ROE by 1.8 percentage points. By introducing the comprehensive efficiency package, the erosion of returns was dramatically mitigated.

In sum, the profit-enhancing and risk management potential for energy and water management is clearly significant, and largely untapped in segments of the real estate industry. [1]

[1] Thanks to David Christensen of Nearon Enterprises for providing the inspiration and tools with which to perform this analysis. This work was supported by the Assistant Secretary for Energy Efficiency and Renewable Energy. Office of Building Technology, State and Community Programs. Office of Building Research and Standards, U.S. Department of Energy under Contract No. DE-AC03 76SF00098 and the U.S. Environmental Protection Agency, Climate Protection Division, Contract DW8993901101.

## OVERVIEW

The cost of providing energy in U.S. multifamily buildings (5 or more units) reached $12 billion in 1997, with an average of $755 per household, as shown in Figure 1 (EIA 2002a). Non-residential buildings consumed $70 billion in 1995, with an average of $1.19/sq.ft, ranging from $0.48/sq. ft. for religious worship buildings to $4.11/sq. ft. for food sales properties, as shown in Figure 2 (EIA 2002b). Even vacant buildings used $0.27/sq. ft., on average.

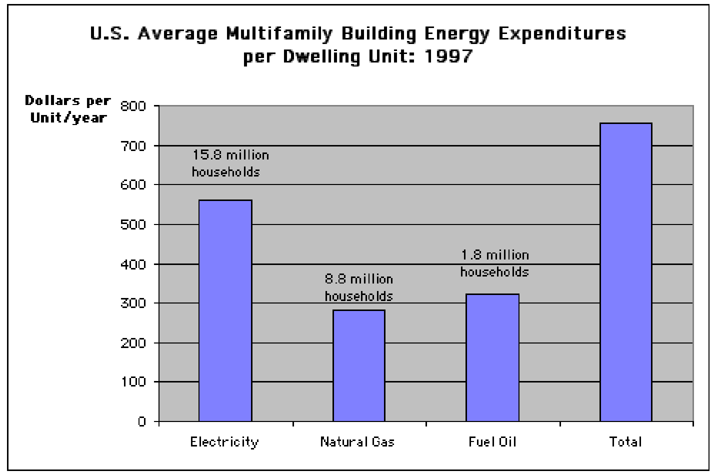



*Figure 1.* Energy costs in multifamily properties. Energy costs are shown by fuel for units using the given energy source. Source: U.S. Department of Energy, Energy Information Administration (2000a).

The management of energy use became popular during the oil crises of the 1970s, and has more recently seen a revival of interest in response to problems with electricity reliability resulting from poor implementation of utility restructuring and deregulation. Management of water use has also received some interest, although less so than has energy. A subset of efficiency-improvements yield both types of savings, e.g. water-efficient laundry equipment also reduces water heating demand. While considerable efforts have been made, untapped opportunities and a continuous stream of new technologies and strategies provide significant remaining potential.

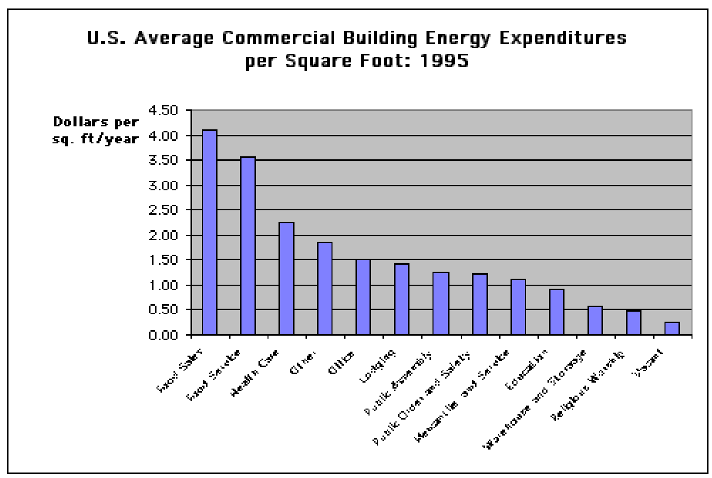



*Figure 2.* Energy costs in commercial properties. Source: U.S. Department of Energy, Energy Information Administration (2002b).

Because expenditures aimed at trimming energy and water use yield reduced operating costs, they are properly evaluated as investments rather than simple expenses. It is well known that these investments yield payback times on the order of months or years, and are thus widely regarded as cost-effective from this perspective.

For real estate investors, evaluating the economic consequences of such investments must be considered in the context of cashflow and tax analyses. Reduced utility costs translate into increased Net Operating Income (NOI)[2], which in turn influences net taxable income

[2] The NOI is defined as pre-tax operating income minus operating expenses, excluding debt service.

as well as the various operating ratios for a property. The most profound effect is on property resale ("reversion") value, which can be estimated as the ratio of NOI to the prevailing capitalization (CAP) rate[3]. For example, at a CAP rate of 10%, one-dollar of energy savings will increase resale value by ten dollars. Adjustments must be made for the up-front cash infusion required to obtain the operating cost reduction. This can be booked in a single year or financed.

Lease structures are clearly central to determining the allocation of financial benefits. Triple-net leases are such that owners do not incur the costs of energy and water, whereas standard leases allocate these costs either to landlord or tenant. Common-area energy and water uses are normally the responsibility of the property owner. Costs for utilities are often shared, e.g., with the owner providing heat or hot water, and tenants picking up the remaining costs. In any case, if the implications of utility costs are properly identified and communicated, potential tenants will value an energy-efficient property over a conventional property, as their operating costs will be lower. In an ideal world, this would translate into willingness to pay incrementally higher lease rates and a corresponding competitive advantage for owners of efficient properties. Even in the absence of this valuation, owner costs can be considerable as exemplified by a subject 120-unit apartment complex in Boise Idaho, where common-area utility expenses are $400/unit-year, which is only 4.8% of potential rent income versus 26% of net cash flow before taxes.

There are many nuances in the realm of energy and water management analyses. Among these are interactions among measures. For example, if the owner is considering a more efficient heating ventilating and air conditioning system (HVAC) as well as efficient windows, proper analysis will show that the combined savings of both measures will be less than the sum of individual savings. This occurs because the better windows reduce the demand for space conditioning, and thus the operating hours of the HVAC system.

## ANCILLARY BENEFITS

Some efficiency investments also reduce maintenance costs. The most well known example is in the case of compact fluorescent lamps to replace incandescent lamps. The per-bulb energy savings is on the order of 75%, but, in addition, these lamps last for approximately 10,000 hours as opposed to 1,000 hours for standard lamps. Thus, ten or so lamp changes (and the associated labor costs) are also avoided. Another example is evidenced by the prolonged roof lifetime achieved by lightening roof color as a means of reducing summertime heat gains and air conditioning costs (Rosenfeld et al. 1995).

Efficient equipment is by definition newer, but also tends to be of higher quality. This may manifest in longer service life, lower repair cost, quieter or safer operation, etc. (Mills and Rosenfeld 1996). An efficient and "green" property may have additional "curb appeal" for tenants or prospective buyers in certain marketplaces.

---

[3] The CAP rate (also knows as return on assets, ROA) is defined as the ratio of NOI to the property value. Thus, the ratio NOI/CAP provides an approximation of property value.

## Assessing the Opportunity

Determining baseline energy and water use and costs is a key starting point. Many factors are involved, not the least of which is the year-to-year variation in weather. Short periods of utility bill history must be taken with a grain of salt. Also, different occupants use energy differently, and thus past occupancy may not provide a reliable proxy for costs that will be incurred by prospective tenants.

A common way of addressing these kinds of uncertainties is to perform computer simulations in which all physical and occupancy characteristics can be explicitly stipulated, and varied. Many such tools are available (see: http://www.eren.doe/gov/buildings/energy_tools/). Care must be taken in that the quality of these tools and skill of their users varies widely (Mills 2002).

An industry of "energy auditors" and other professional service providers has grown up in parallel with the interest in energy management. Many energy and water providers (utilities) also provide such services, as well as financial incentives (e.g. rebates) to purchasers of efficient equipment or services. There also exist firms—typically called Energy Service Companies (ESCOs)—who will invest capital in a property in return for a share of the energy savings (Goldman et al., 2002). The National Association of Energy Service Companies (NAESCO), accredits these firms, holds annual meetings, etc. see: http://www.naesco.org.

Energy and water surveys must also ascertain the performance of existing equipment compared to current codes. Especially in the case of energy, a wide range of prevailing mandatory equipment standards will automatically result in an improvement of efficiency if a device is replaced (i.e. even if no special effort is made to select a premium-efficiency model). For example, the maximum-allowed energy use of a refrigerator purchased today will be at least half that of vintage-1990 models. In turn, the best-on-the-market, will yield an additional 50% savings (Figure 3).

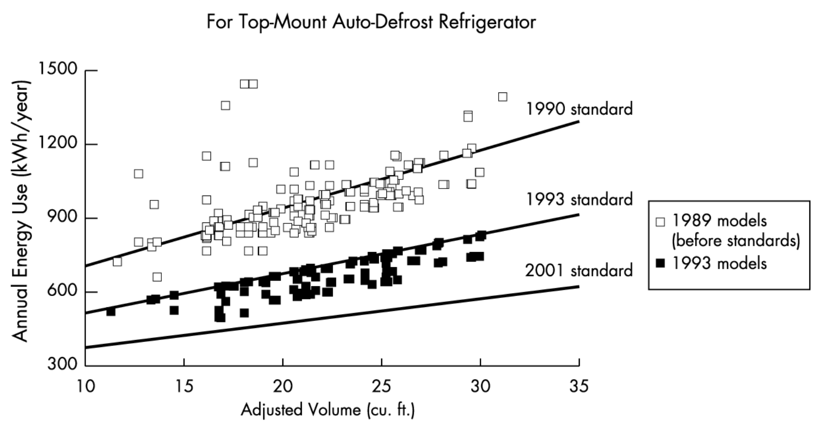



***Figure 3.*** *Range of refrigerator efficiencies on the market, and shifts due to mandatory standards . Each data-point corresponds to a refrigerator model on the market in the year indicated. (Source: Lawrence Berkeley National Laboratory).*

A range of important considerations must be taken into account when analyzing the cost of utility efficiency upgrades. The investment requirement is typically defined as the cost premium compared to typical efficiencies (or those required under current standards), assuming that the upgrades are made during the natural course of replacement. In some cases, however, accelerated replacement is also motivated (which requires that prorated capital and associated labor and installation costs also be weighed against the energy savings cash-flow). Incremental costs will normally be lower in new construction than in the case of retrofit, and in many cases can net to zero because central air-conditioning systems can be downsized if other energy-related equipment in the building is efficient (and thus giving off less waste heat). Moreover, there often exist "non-capital" opportunities to reduce costs through better maintenance of energy-using equipment (see: http://www.eren.doegov/buildings/highperformance). Care must also be taken to utilize the appropriate energy and water prices when calculating the impact on operating costs and cash flow. Using nominal prices (total bills divided by total consumption) will overstate savings because various fixed costs are typically included in the bill. This is particularly important in the case of water, where nearly half of the nominal price can be fixed costs.

## MANAGING RISK & VOLATILITY

A key source of real-estate investment risk is volatility in operating expenses, and their escalation rates. Energy, especially in California, has proven to be a particular wildcard in this respect. Managing energy use is one way of limiting this risk, i.e., the lower the quantity consumed the less the potential variability in costs.

Another source of risk are uncertainties about the actual savings obtained from investments in reduced utility use. Simulation models of course have limitations, and real-world factors can confound the best-laid plans.

Of particular importance, quality assurance is key to achieving predicted savings. Researchers and the energy services industry have invested considerable effort in developing techniques generally known as "commissioning" to ensure that savings are adequately captured (see: http://www.peci.org/cx/index.html).

Another caveat is that manufacturers' claims about equipment performance can be incomparable with one another at best (e.g. due to arbitrary testing procedures) and suspect at worst. Government performance rating systems such as the ENERGY STAR building and equipment labels promulgated by the U.S. Environmental Protection Agency (see: http://www.energystar.gov) and U.S. Department of Energy, or the *EnerGuide* labels required by the Federal Trade Commission (see http://www.ftc.gov/bcp/conline/edscams/eande/index.html) go a long way towards addressing such issues. For larger properties, in-house programs for measuring and tracking energy use are also merited.

Insurance companies have begun to offer energy savings insurance (ESI) to help investors hedge these risks (Mills 2002). With ESI, the building owner and lender are guaranteed a contracted level of savings.

A key crosscutting issue is the need for industry standards for quantifying and verifying energy and water savings. The International Performance Measurement and Verification Protocols (see http://www.ipmvp.org) have made considerable strides in this direction.

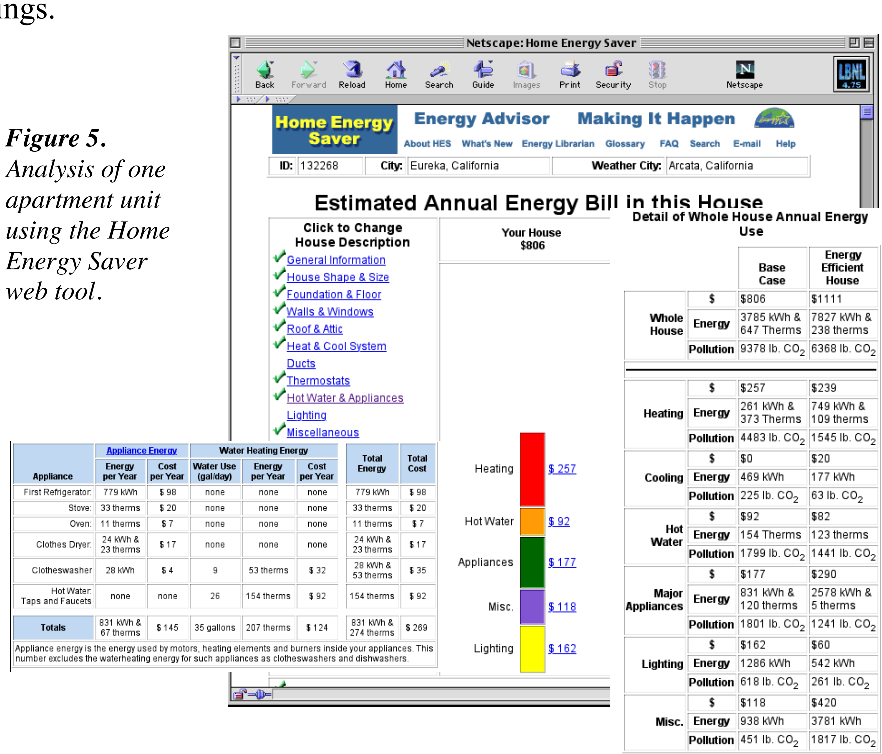
# Case Study: Eureka California

The aforementioned concepts are illustrated for the case of a six-unit apartment building located in Eureka, California (Figure 4). A baseline setup and 5-year operating profile is provided in Appendix 1. The property is not individually metered, and thus the owner has a particular interest in managing the energy costs.

*Figure 4. Subject property.*


A walk-through survey was conducted to generate a list of existing energy- and water-using equipment, and identify possible approaches to managing utility costs. Then, using a web-based simulation (see: http://HomeEnergySaver.lbl.gov), energy use under typical weather conditions was estimated (Figure 5). Engineering estimates were then made for water savings opportunities (Table 1). Various features of the building were then modified (e.g., insulation levels in the attic) to determine the anticipated energy savings.

*Figure 5. Analysis of one apartment unit using the Home Energy Saver web tool.*




| Appliance | Appliance Energy | | Water Heating Energy | | | Total Energy | Total Cost |
|---|---|---|---|---|---|---|---|
| | Energy per Year | Cost per Year | Water Use (gal/day) | Energy per Year | Cost per Year | | |
| First Refrigerator: | 779 kWh | $ 98 | none | none | none | 779 kWh | $ 98 |
| Stove: | 33 therms | $ 20 | none | none | none | 33 therms | $ 20 |
| Oven: | 11 therms | $ 7 | none | none | none | 11 therms | $ 7 |
| Clothes Dryer: | 24 kWh & 23 therms | $ 17 | none | none | none | 24 kWh & 23 therms | $ 17 |
| Clotheswasher | 28 kWh | $ 4 | 9 | 53 therms | $ 32 | 28 kWh & 53 therms | $ 35 |
| Hot Water: Taps and Faucets | none | none | 26 | 154 therms | $ 92 | 154 therms | $ 92 |
| Totals | 831 kWh & 67 therms | $ 145 | 35 gallons | 207 therms | $ 124 | 831 kWh & 274 therms | $ 269 |

Appliance energy is the energy used by motors, heating elements and burners inside your appliances. This number excludes the waterheating energy for such appliances as clotheswashers and dishwashers.

Detail of Whole House Annual Energy Use

| | | Base Case | Energy Efficient House |
|---|---|---|---|
| Whole House | $ | $806 | $1111 |
| | Energy | 3785 kWh & 647 Therms | 7827 kWh & 238 therms |
| | Pollution | 9378 lb. $CO_2$ | 6368 lb. $CO_2$ |
| Heating | $ | $257 | $239 |
| | Energy | 261 kWh & 373 Therms | 749 kWh & 109 therms |
| | Pollution | 4483 lb. $CO_2$ | 1545 lb. $CO_2$ |
| Cooling | $ | $0 | $20 |
| | Energy | 469 kWh | 177 kWh |
| | Pollution | 225 lb. $CO_2$ | 63 lb. $CO_2$ |
| Hot Water | $ | $92 | $82 |
| | Energy | 154 Therms | 123 therms |
| | Pollution | 1799 lb. $CO_2$ | 1441 lb. $CO_2$ |
| Major Appliances | $ | $177 | $290 |
| | Energy | 831 kWh & 120 therms | 2578 kWh & 5 therms |
| | Pollution | 1801 lb. $CO_2$ | 1241 lb. $CO_2$ |
| Lighting | $ | $162 | $60 |
| | Energy | 1286 kWh | 542 kWh |
| | Pollution | 618 lb. $CO_2$ | 261 lb. $CO_2$ |
| Misc. | $ | $118 | $420 |
| | Energy | 938 kWh | 3781 kWh |
| | Pollution | 451 lb. $CO_2$ | 1817 lb. $CO_2$ |

*__Table 1.__ Estimates of Baseline Energy & Water Use and Savings.*

| Engineering estimates of use and savings for efficiency upgrades. Values are totals for the six apartments in the subject property. | | | | | |
|---|---|---|---|---|---|
| | Cost | Savings | Notes | | |
| **GRAND TOTALS** | 4,039 | 2,805 | | | |
| | | | | | |
| **ENERGY MANAGEMENT** | | | | | |
| **1. Energy-only Measures** | Cost | Savings | Analyzed using the Home Energy Saver, http://HES.lbl.gov, run number 13 | | |
| Attic Insulation | 875 | 480 | From R0 to R38 | | |
| Weatherstripping | 150 | 397 | | | |
| Compact Fluorescent Lamps | 154 | 422 | $5/unit x 5 per apartment x 6 apartments + 4 outdoors | | |
| Duct Sealing and Insulation | 150 | 100 | | | |
| Refrigerator upgrades | 300 | 240 | US Average Use for 1995 vintage models is $98/year. | | |
| Water Heaters | 600 | 392 | | | |
| Efficient Windows | 700 | 96 | $1/square foot x 700 square feet | | |
| Total | 2,929 | 2,127 | | | |
| | | | | | |
| **WATER/ENERGY MANAGEMENT** | | | | | |
| Summary of following 3 items | | | | | |
| Total Cost | $1,110 | | | | |
| Total Water Savings | 210 | | | | |
| Total Energy Savings | 467 | | | | |
| Total Operating Cost Savings | 678 | | | | |
| | | | | | |
| **1. Low-Flow Toilets: Replace 5-gallon with 1.5-gallon units** | $660 | cost for 6 toilets (installed) | | | |
| Water Savings | 6 | toilets per building | | | |
| | 5 | flushes per day | | | |
| | 3.5 | gallons saved per flush | | | |
| | 365 | days/year | | | |
| | 38,325 | gallons saved | | | |
| | 5,110 | 100cubic feet saved | | | |
| Total water savings | 87 | $/year water savings | | | |
| | | | | | |
| **2. Low-flow showerheads** | 150 | $25 cost per showerhead (installed) | | | |
| Usage | 1 | shower per day | | | |
| | 3.5 | gallons/minute (standard model) | | | |
| | 1.5 | gallons/minute (efficient model | | | |
| | 10 | shower duration (minutes) | | | |
| Water Savings | 2.0 | gallons/minute | | | |
| | 6.0 | apartments | | | |
| | 43,800 | gallons | | | |
| | 58 | 100cf | | | |
| | 100 | $/year water savings | | | |
| Energy Savings | 269 | $/year energy savings | | | |
| | | | | | |
| Total (energy + water savings) | 369 | | | | |
| | | | | | |
| **3. Horizontal-axis clotheswasher** | | cost permium for efficient model | | | |
| Incremental cost over current standard | 300 | | | | |
| Assume 15 loads/week | | | | | |
| Energy (Baseline values - 6 households | Washer | | Dryer | | Cost |
| Gas | 318 | | 138 | therms | $ 457 |
| Elect | 168 | | 144 | kWh | $ 39 |
| | | | | | |
| Energy Savings | 198 | $/year energy savings | | | |
| | | | | | |
| Water | 69 | baseline consumption: gallons/day | | | |
| | 28 | savings (40%) | | | |
| | 13 | 100s of cubic feet | | | |
| Water Savings | 23 | $/year water savings | | | |
| Total (energy + water savings) | 221 | $/year total savings | | | |

## RESULTS & DISCUSSION

The results suggest rather dramatic benefits of making investments in reduced energy and water consumption (Figure 6 and Table 2). The analysis examined a potential one-time investment of $0.95/sq. ft. for all upgrades combined (1.8% of the purchase price) resulting in reduced annual operating costs of $0.66/square foot (15% of NOI). This translated into an increase in an after-tax year-five return on equity (also known as "cash—on-cash return") from 12.3% to 16.9%, and an increase in internal rate of return from 23% to 27%. This in turn corresponds to an increase in after-tax net present value (NPV, d=10%) of $29,120 (over a five-year holding period), and a bump in resale value of $21,300 to 26,400 (for CAP rates of 9% and 7%, respectively). Approximately three-quarters of the case study benefits arose from energy-only improvements, with the balance associated with water-only or water-and-energy upgrades.

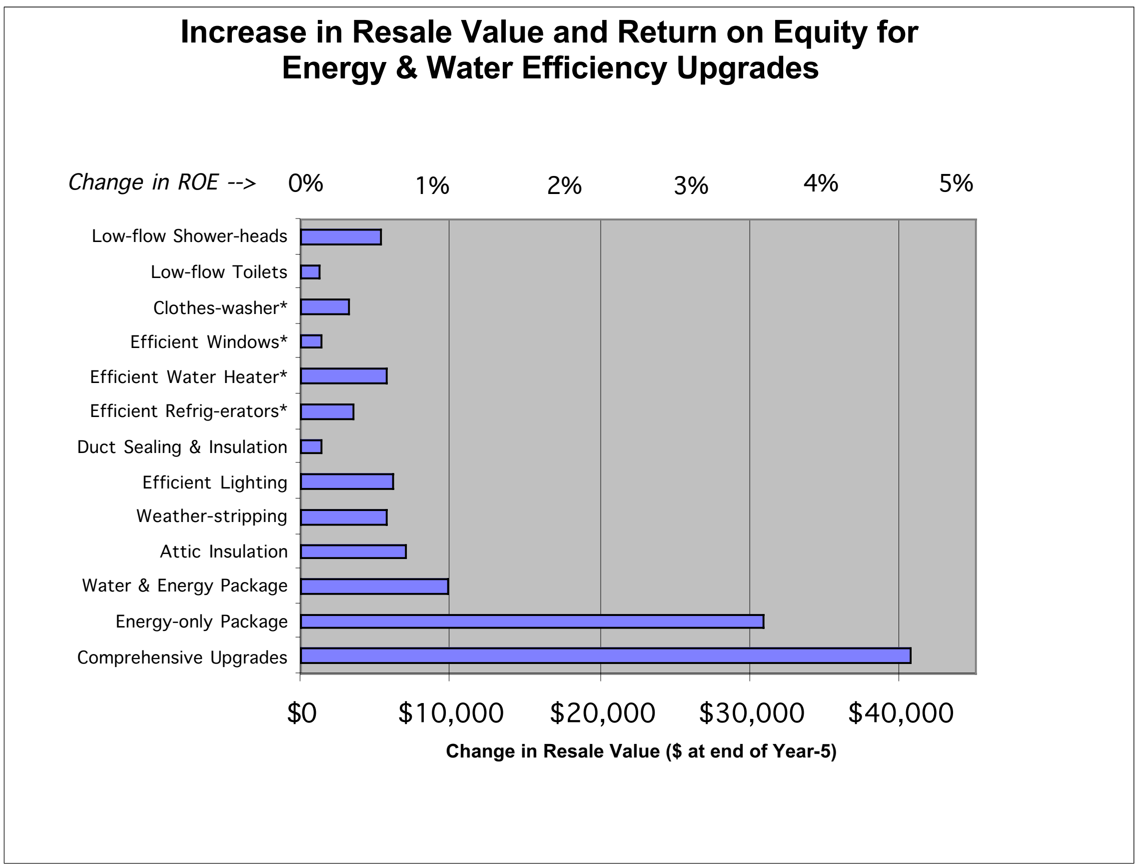



***Figure 6.*** *Profitability impacts of energy- and water-efficiency upgrades. Baseline values are 12.3% year-5 pre-tax ROE and a $330,307 sale value. More details shown in Table 2.*

***Table 2.*** *Financial-performance impacts of individual energy- and water-efficiency upgrades and packages. Total values shown for the Baseline case; changes (delta values) shown for all scenarios.*

| | Baseline | All | Packages for Water and Energy | | Individual Measures for Water and Energy | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No Upgrades | Comprehensive Upgrades | Energy-only Package | Water & Energy Package | Attic Insulation | Weather-stripping | Efficient Lighting | Duct Sealing & Insulation | Efficient Refrig-erators* | Efficient Water Heater* | Efficient Windows* | Clothes-washer* | Low-flow Toilets | Low-flow Shower-heads |
| Investment ($) | - | 4,039 | 2,929 | 1,110 | 875 | 150 | 154 | 150 | 300 | 600 | 700 | 300 | 660 | 150 |
| Utility Operating Cost Savings ($/year) | - | 2,805 | 2,127 | 678 | 480 | 397 | 422 | 100 | 240 | 392 | 96 | 221 | 87 | 369 |
| Simple payback time (years) | | 1.4 | 1.4 | 1.6 | 1.8 | 0.4 | 0.4 | 1.5 | 1.3 | 1.5 | 7.3 | 1.4 | 7.6 | 0.4 |
| Differential Net Operating Income ($, year-1) | 18,951 | 2,805 | 2,127 | 678 | 480 | 397 | 422 | 100 | 240 | 392 | 96 | 221 | 87 | 369 |
| Differential Net Present Value ($, <tax) | 47,892 | 29,120 | 22,206 | 6,914 | 4,816 | 4,499 | 4,796 | 1,033 | 2,533 | 4,042 | 486 | 2,315 | 422 | 4,177 |
| Differential Property Value ($, end of Year-5) | | | | | | | | | | | | | | |
| @7% CAP | 377,494 | 46,450 | 35,227 | 11,223 | 7,949 | 6,566 | 6,992 | 1,656 | 3,975 | 6,499 | 1,590 | 3,666 | 1,447 | 6,110 |
| @8% CAP | 330,307 | 40,644 | 30,823 | 9,820 | 6,956 | 5,746 | 6,118 | 1,449 | 3,478 | 5,686 | 1,391 | 3,207 | 1,266 | 5,347 |
| @9% CAP | 293,606 | 36,128 | 27,399 | 8,729 | 6,183 | 5,107 | 5,438 | 1,288 | 3,091 | 5,054 | 1,237 | 2,851 | 1,126 | 4,753 |
| Change in Property Value / Investment (ratio) | - | 10.1 | 7.6 | 2.4 | 1.7 | 1.4 | 1.5 | 0.4 | 0.9 | 1.4 | 0.3 | 0.8 | 0.3 | 1.3 |
| Change in debt-coverage ratio (year-2) | 1.52 | 0.22 | 0.16 | 0.05 | 0.04 | 0.03 | 0.03 | 0.01 | 0.02 | 0.03 | 0.01 | 0.02 | 0.01 | 0.03 |
| Return on Assets, ROA (<tax, year-5) | 11.3% | 1.4% | 1.1% | 0.3% | 0.2% | 0.2% | 0.2% | 0.1% | 0.1% | 0.2% | 0.05% | 0.1% | 0.04% | 0.2% |
| Return on Equity, ROE (<tax, year-5) | 12.3% | 4.7% | 3.5% | 1.1% | 0.8% | 0.7% | 0.7% | 0.2% | 0.4% | 0.7% | 0.2% | 0.4% | 0.1% | 0.6% |
| Internal Rate of Return, IRR (<tax) | 21.3% | 5.3% | 4.1% | 1.3% | 0.9% | 0.9% | 1.0% | 0.2% | 0.5% | 0.8% | 0.04% | 0.5% | 0.03% | 0.8% |
| Change in ratio of NPV to initial investment (%-points) | 70.7% | 43.0% | 32.8% | 10.2% | 7.1% | 6.6% | 7.1% | 1.5% | 3.7% | 6.0% | 0.7% | 3.4% | 0.6% | 6.2% |

**Notes:**
Assumes investment made all in first year (I.e. not fina
Net present values calculated at a 10% discount rate.
* Measure costs are incremental to equipment meeting current minimum-efficiency standards. Other measures include full purchase and installation costs.

The results clearly vary widely by the type of upgrade in question. At one end of the spectrum, lighting upgrades pay for themselves in 5 months, and increase the property value by 40-times the initial investment cost. At the other end of the spectrum, efficient windows typically have relatively limited cost-effectiveness, due to their high first cost,[4] and as a result increased the property value by "only" 2-times the initial investment. There are four additional ways to put the operating cost savings into perspective:

- *Expressed as an equivalent change in vacancy rate.* In the case study, the improvement in NOI equates to an 8-percentage-point decrease in the first-year break-even vacancy rate (from 25% to 33%).[5]

- *Expressed as a reduction in Debt Coverage Ratio, a measure of the adequacy of operating income to cover debt service.[6]* In the case study, the baseline year-5 DCR is 1.5, which increases to 2.09 under the efficiency scenario.

- *Expressed in terms of the project's "profitability index"—defined as the ratio of the after-tax NPV to the initial investment.* In the case study, the profitability index improves from roughly 70% for the baseline property to 140% for the efficiency scenario.

[4] This is especially the case in non-extreme climates such as Eureka, which has no air-conditioning needs and where wintertime temperatures are moderated by the ocean. However, it is important not to overlook other amenities (fire safety, noise, UV control) (Mills and Rosenfeld 1996).

[5] The break-even vacancy rate is defined as (Fixed Expenses + Debt Service) / (Gross Rent per unit - Variable Expenses per unit).

[6] The Debt-coverage Ratio (DCR) is defined as the ratio of Net Operating Income to Debt Service. Banks often stipulate covenants that properties not fall below a certain DCR, e.g. 1.3, and have the option to foreclose on a property if the terms are violated.

• *And, lastly, expressed as a hedge against energy price increases* (Figure 7). As an illustration, a sensitivity analysis of 6% annual expense price escalation factor (including energy)—as opposed to the 3% baseline—dropped the year-5 Return on Equity by about 1% point (10%), while a one-time 20% price shock in year-5 cut the ROE by 8.1 percentage-points (75%).[7] By introducing the comprehensive energy/water package, the ROE was essentially maintained for the 6% growth rate, and fell only 25% under the price-shock scenario. The baseline ROE (4.2%) under the price shock falls well below the financing cost for this project.

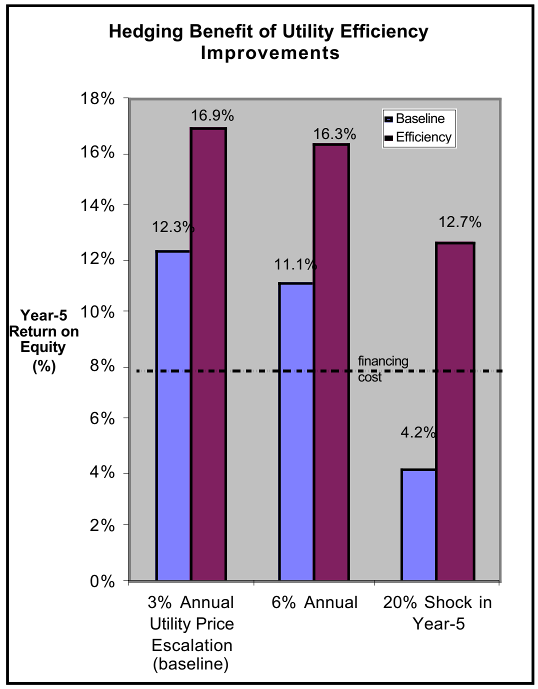



***Figure 7****. Energy and water efficiency improvements function as a hedge against utility price increases.*

* * *

In sum, the profit-enhancing and risk management potential for energy and water management is clearly significant, and largely untapped in segments of the real estate industry.

## Literature Cited


EIA. 2002a. "Residential Buildings Energy Consumption Surveys." United States Department of Energy, Energy Information Administration. ftp://ftp.eia.doe.gov/pub/consumption/residential/ce_tables/enduse_expend.pdf

EIA. 2002b. "Commercial Buildings Energy Consumption Surveys." United States Department of Energy, Energy Information Administration. ftp://ftp.eia.doe.gov/pub/consumption/commercial/ce95mf.pdf

Goldman, C.A., J.G. Osborne, N.C. Hopper, T.E. Singer. "Market Trends in The U.S. ESCO Industry: Results from the NAESCO Database Project". Lawrence Berkeley National Laboratory Report No. 50304 . http://eetd.lbl.gov/ea/ems/reports/50304.pdf


[7] Escalation rates were far higher than this during the California energy crisis of 2001.

Mills, E. 2002. "Review and Comparison of Web- and Disk-based Tools for Residential Energy Analysis." Lawrence Berkeley National Laboratory Technical Report No. 50950. http://eetd.lbl.gov/emills/PUBS/SoftwareReview.html

Mills, E. 2002. "Risk Transfer via Energy Savings Insurance." Energy Policy (forthcoming.) Lawrence Berkeley National Laboratory Technical Report No. 48927. http://eetd.lbl.gov/emills/PUBS/EnergySavingsInsurance.html

Mills, E. and A. Rosenfeld. 1996. "Consumer Non-Energy Benefits as a Motivation for Making Energy-Efficiency Improvements." *Energy—The International Journal*, 21 (7/8):707-720. (Also in *Proceedings of the 1994 ACEEE Summer Study on Energy Efficiency in Buildings,* pp. 4.201-4.213.)

Rosenfeld, A.H., H. Akbari, S. Bretz, B.L. Fishman, D.M. Kurn, D. Sailor, H. Taha. 1995. "Mitigation of Urban Heat Islands: Materials, Utility Programs, Updates." *Energy and Buildings, 22*:255-265.

# APPENDIX 1

## Baseline Analysis
## Eureka, California

*The following analyses represent the base-case, plus a downside sensitivity analysis for key assumptions. This spreadsheet framework was used to evaluate the various investments in utility efficiency upgrades described in the report. Note: per the property management firm handling the building, current vacancy rates are <1%, and rent increases over the past 3 years have averaged 15% per annum. Eureka's economy is not as susceptible to the ebbs and flows of the "tech" economy as are many other parts of California. Replacement Reserves are based on local equipment and labor prices.*

## Assumptions

| | |
|---|---|
| Ordinary Income Tax Bracket | 27% |
| Capital Gain Max Tax Rate | 20% |
| Tax Rate on Straight Line Recapture | 25% |
| Month Placed in Service: (from CashFlows Sheet) | 1 |

| Year----> | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Vacancy Rates (enter just year 1, or each year) | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% |
| Rent Income Escalators (enter just year 2, or each year) | | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% |
| Other Income Escalator, with vacancy | | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% |
| Other Income Escalator, without vacancy | | 3.00% | 3.00% | 3.00% | 3.00% | 3.00% |
| Expense Escalators | | | | | | |
| Gas & Electric | | 3.00% | 3.00% | 3.00% | 3.00% | 3.00% |
| Water | | 3.00% | 3.00% | 3.00% | 3.00% | 3.00% |
| Other | | 3.00% | 3.00% | 3.00% | 3.00% | 3.00% |

| | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|
| Cap rate used in Sale | 7.00% | 8.00% | 9.00% |

| | | |
|---|---|---|
| Expenses of Sale | 6.00% | |
| Property Tax Rate | 1.05% | |
| Discount Rate for NPV | 10.00% | |
| Management Fee | 8.00% | of collected rents |

## Replacement Reserves

| | Number | Unit Replacement Costs ($) | Value ($) | Life for Reserves (years) | Required Reserve ($/year) | Life for Depreciation (years) | Annual personal property depreciation amount |
|---|---|---|---|---|---|---|---|
| **5-year Property** | | | | | | | |
| Refrigerators | 6 | 700 | 4200 | 15 | 280 | 5 | 840 |
| Stoves | 6 | 700 | 4200 | 15 | 280 | 5 | 840 |
| Oven | | | 0 | 15 | 0 | 5 | 0 |
| Water Heaters | 3 | 800 | 2400 | 15 | 160 | 5 | 480 |
| Washer | 1 | 1500 | 1500 | 10 | 150 | 5 | 300 |
| Dryer | 1 | 700 | 700 | 10 | 70 | 5 | 140 |
| HVAC | 6 | 1500 | 9000 | 10 | 900 | 5 | 1800 |
| Kitchen cabinets | 6 | 1500 | 9000 | 5 | | 5 | 1800 |
| Furniture, etc. | | | 0 | 5 | | 5 | 0 |
| **10-year Property** | | | | | | | |
| Carpet (square feet) | 1500 | 2.00 | 3000 | 6 | 500 | 10 | 300 |
| Window coverings | 6 | 200 | 1200 | 6 | 200 | 10 | 120 |
| **15-year Property** | | | | | | | |
| Parking/Sidewalks | 1 | 15000 | 15000 | 25 | | 15 | 1000 |
| **Insurance deductible** | 1 | 1000 | | 5 | 200 | | |
| Total | | | 50,200 | | 2,740 | | 7,620 |

# SETUP: Annual Property Operating Data

**(Yellow cells to be filled by user)**

| | | | | |
|---|---|---|---|---|
| **Property Name** | N Street | | | |
| Location | Eureka | | | |
| Type of Property | Residential, six-plex | | | |
| Size of Property | | | | |
| Number of Units | 6 | gross sf | usable sf | efficiency (G/U) |
| Floor Area (sq. ft.) | | 4,264 | 3,980 | ### |
| Purchase Price | 219,500 | 36,583 $/unit | | 55 $/sq ft (gross) |
| + Acquisition Costs | 719 | 220,219 purchase price, less points | | |
| + Loan Points | 1,540 | | | |
| - Mortgages | 154,000 | | | |
| = Initial Investment | 67,759 | | LTV: ### | |

| | Stabilized Year 1 | Year 5 | |
|---|---|---|---|
| **CFAT** | **4,161** | **7,850** | |
| **ROE (Cash-on-Cash)** | **4.2%** | **12.3%** | |
| **CAP** | **8.6%** | **11.3%** | |
| **Leverage** | **1.4%** | **4.0%** | "positive" if >0 |

| Assessed/Appraised Values | ($000) | (%) |
|---|---|---|
| Land | 33,033 | 15% |
| Improvements | 136,986 | 62% |
| Personal Property | 50,200 | 23% |
| Total | 220,219 | 100.0% |
| Adjusted Basis as of: 23-Nov-02 | | $220,219 |

**Mortgage Data**

| | 1st Mortgage | 2nd Mortgage |
|---|---|---|
| Amount | 154,000 | |
| Interest Rate | 7.250% | |
| Amortization Period | 25 | |
| Loan Term | 15 | |
| Payments/Year | 12 | 12 |
| Periodic Payment | 1,113.12 | - |
| Annual Debt Service | 13,357 | - |
| Points | 1,540 | |

**Cost Recovery Data**

| | Improvements | Personal Property |
|---|---|---|
| Value | 136,986 | 50,200 |
| C. R. Method | SL | see worksheet |
| Useful Life | 27.5 | |
| In Service Date | January-02 | January-02 |
| Date of Sale | December-06 | December-06 |
| Recapture | | |
| Investment Tax Credit ($$ or %) | | |

| | ALL FIGURES ARE ANNUAL | $/SQ FT or $/Unit | or % of GOI | | | COMMENTS/FOOTNOTES |
|---|---|---|---|---|---|---|
| 1 | **POTENTIAL RENTAL INCOME** | | | | 37,680 | First-year stabilized rents |
| 2 | - Other Income (affected by vacancy) | | | | 2,400 | Laundry |
| 3 | - Vacancy & Cr. Losses | ( | 5% of | 40,080 | 2,004 | |
| 4 | **EFFECTIVE RENTAL INCOME** | | | | 38,076 | |
| 5 | Plus: Other Income (not affected by vacancy) | | | | | |
| 6 | **GROSS OPERATING INCOME** | | | | 38,076 | |
| | **OPERATING EXPENSES:** | | | | | |
| 7 | Real Estate Taxes | | | 2,305 | | |
| 8 | Personal Property Taxes | | | | | |
| 9 | Property Insurance | | | 3,426 | | Includes liability coverage |
| 10 | Off-Site Management | | | 3,046 | | Includes bookkeeping, credit reports, repairs supervision. |
| 11 | Payroll | | | | | |
| 12 | Expenses/Benefits | | | | | |
| 13 | Taxes/Worker's Compensation | | | | | |
| 14 | Repairs and Maintenance | | | 848 | | Average of past 6 years, under former owner |
| | Utilities: | | | | | |
| 15 | Gas and electricity | | | 4,000 | | |
| 16 | Garbage | | | 952 | | |
| 17 | Water & Sewer | | | 1,800 | | |
| 18 | | | | | | |
| 19 | Accounting and Legal | | | 2,200 | | |
| 20 | Licenses/Permits | | | 28 | | |
| 21 | Advertising | | | 100 | | Most advertising expenses paid by off-site manager |
| 22 | Supplies | | | | | |
| 23 | Miscellaneous Contract Services: | | | | | |
| 24 | Gardening | | | 420 | | |
| 25 | | | | | | |
| 26 | | | | | | |
| 27 | | | | | | |
| 28 | | | | | | |
| 29 | **TOTAL OPERATING EXPENSES** | | | | 19,125 | |
| 30 | **NET OPERATING INCOME** | | | | 18,951 | |
| 31 | - Annual Debt Service | | | | 13,357 | |
| 32 | - Funded Reserves | | | | 2,740 | |
| 33 | - Leasing Commissions | | | | | |
| 34 | - Capital Additions | | | | | |
| 35 | **CASH FLOW BEFORE TAXES** | | | | 2,854 | |

**NOTE: This workbook adapted from a version provided by Gary G. Tharp, CCIM Institute**

407/862-9206 Fax: 407/862-3666

gary@orlando.com

# Cash Flow Analysis Worksheet

| | Taxable Income | Escal. | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|
| 1 | **Potential Rental Income** | 5.0% | 37,680 | 39,564 | 41,542 | 43,619 | 45,800 | 48,090 |
| 2 | + Other Income affected by vacancy | 5.0% | 2,400 | 2,520 | 2,646 | 2,778 | 2,917 | 3,063 |
| 3 | - Vacancy & Credit Losses | 5.0% | (2,004) | (2,104) | (2,209) | (2,320) | (2,436) | (2,558) |
| 4 | = Effective Rental Income | | 38,076 | 39,980 | 41,979 | 44,078 | 46,282 | 48,596 |
| 5 | + Other Income not affected by vacancy | 3.0% | | | | | | |
| 6 | = Gross Operating Income | | 38,076 | 39,980 | 41,979 | 44,078 | 46,282 | 48,596 |
| 7 | - Operating Expenses | mixed | (19,125) | (19,699) | (20,290) | (20,898) | (21,525) | (22,171) |
| **8** | **= NET OPERATING INCOME** | | **18,951** | **20,281** | **21,689** | **23,179** | **24,756** | **26,425** |
| 9 | - Interest (1st Mortgage) | | (11,091) | (10,921) | (10,738) | (10,542) | (10,331) | |
| 10 | - Interest (2nd Mortgage) | | | | | | | |
| 11 | - Depreciation (improvements) | | (4,981) | (4,981) | (4,981) | (4,981) | (4,981) | |
| 12 | - Depreciation (Personal Property) | | (7,620) | (7,620) | (7,620) | (7,620) | (7,620) | |
| 13 | - Amortization of Loan Points | | (103) | (103) | (103) | (103) | (103) | |
| 14 | - Leasing Commissions | | | | | | | |
| 15 | = Real Estate Taxable Income | | (4,844) | (3,344) | (1,753) | (66) | 1,722 | |
| **16** | **Tax Liability (Savings) at 27.0%** | | **(1,308)** | **(903)** | **(473)** | **(18)** | **465** | |
| | **Cash Flow** | | | | | | | |
| | **Cash Flow From Operations (CFO)** | | 21,691 | 23,103 | 24,596 | 26,173 | 27,840 | |
| 17 | **NET OPERATING INCOME** (Line 8) | | **18,951** | **20,281** | **21,689** | **23,179** | **24,756** | |
| 18 | - Annual Debt Service (P&I) | | (13,357) | (13,357) | (13,357) | (13,357) | (13,357) | |
| 19 | - Reserves for Replacements | 3.0% | (2,740) | (2,822) | (2,907) | (2,994) | (3,084) | |
| 20 | - Energy/Water Efficiency Measures | | | | | | | |
| **21** | **= CASH FLOW BEFORE TAXES** | | **2,854** | **4,101** | **5,425** | **6,828** | **8,315** | |
| 22 | - Tax Liability (Savings) (Line 16) | | (1,308) | (903) | (473) | (18) | 465 | |
| 23 | + Investment Tax Credit | | | | | | | |
| **24** | **= CASH FLOW AFTER TAXES** | | **4,161** | **5,004** | **5,898** | **6,846** | **7,850** | |

## Ratios & Returns

| | | 2002 | 2003 | 2004 | 2005 | 2006 | |
|---|---|---|---|---|---|---|---|
| **Debt coverage Ratio** | | 1.42 | 1.52 | 1.62 | 1.74 | 1.85 | NO I / Debt Service |
| **Operating Expense Ratio** | | 50% | 49% | 48% | 47% | 47% | Operating Expenses / Gross Operating Income |
| **Break-even analysis (pre-tax)** | | | | | | | |
| occupancy rate (%) | | 85% | 83% | 80% | 78% | 75% | (Fixed Expenses + Debt Service) / (Gross Rent - Variable Expenses) |
| break-even rental income | | 32,482 | 33,056 | 33,647 | 34,256 | 34,883 | (Fixed Expenses + Debt Service) / (Gross Rent per unit - Variable Expenses per unit) * Gross Rent per unit |
| **Performance** | | | | | | | |
| **Return on Assets (CAP, pre-tax)** | | 8.6% | 9.2% | 9.9% | 10.6% | 11.3% | CFO / Purchase Cost |
| **Return on Equity (Cash on Cash Return, pre-tax)** | | 4.2% | 6.1% | 8.0% | 10.1% | 12.3% | CFBT / Cash-in (including repl. reserves) |
| **Value at Purchase-price CAP** | | 219,500 | 234,905 | 251,214 | 268,475 | 286,739 | NOI / CAP |
| **Value at "8-CAP"** | | 236,888 | 253,513 | 271,114 | 289,742 | 309,453 | NOI / 8 |
| **Cashflows** | Initial Investment | CFAT-1 | CFAT-2 | CFAT-3 | CFAT-4 | CFAT-5 | Net proceeds of Sale (at 8% CAP of year-6 NOI) |
| pre-tax | (67,759) | 2,854 | 4,101 | 5,425 | 6,828 | 8,315 | 169,654 |
| after-tax | (67,759) | 4,161 | 5,004 | 5,898 | 6,846 | 7,850 | 169,654 |

assumes 1031 exchange

| | | |
|---|---|---|
| **Internal Rate of Return (IRR)** | | |
| pre-tax | 21.3% | |
| after-tax | 21.9% | |
| **Net Present Value (NPV)** | d= | 10% |
| pre-tax | 47,892 | |
| after-tax | 49,906 | |
| **Profitability Index (NPV/Equity)** | | |
| pre-tax | 70.7% | |
| after-tax | 73.7% | |

# Alternative Cash Sales Worksheet

**Mortgage Balances**

| Year: | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|
| Principal Balance - 1st Mortgage | 151,733 | 149,296 | 146,677 | 143,861 | 140,835 |
| Principal Balance - 2nd Mortgage | | | | | |
| TOTAL UNPAID BALANCE | 151,733 | 149,296 | 146,677 | 143,861 | 140,835 |

**Calculation of Sale Proceeds**

| | | | |
|---|---|---|---|
| PROJECTED SALES PRICE | 377,494 | 330,307 | 293,606 |
| (Based on CAPing year-6 NOI) | 7.00% | 8.00% | 9.00% |
| CALCULATION OF ADJUSTED BASIS: | | | |
| 1 Basis at Acquisition | 220,219 | 220,219 | 220,219 |
| 2 + Capital Additions | | | |
| 3 - Cost Recovery (Depreciation) Taken | 24,907 | 24,907 | 24,907 |
| 4 - Basis in Partial Sales | | | |
| 5 = Adjusted Basis at Sale | 195,312 | 195,312 | 195,312 |
| CALCULATION OF EXCESS COST RECOVERY | | | |
| 6 Total Cost Recovery Taken (Line 3) | 24,907 | 24,907 | 24,907 |
| 7 - Straight Line Cost Recovery | 24,491 | 24,491 | 24,491 |
| 8 = Excess Cost Recovery | 416 | 416 | 416 |
| CALCULATION OF CAPITAL GAIN ON SALE: | | | |
| 9 Sale Price | 377,494 | 330,307 | 293,606 |
| 10 - Costs of Sale | 22,650 | 19,818 | 17,616 |
| 11 - Adjusted Basis at Sale (Line 5) | 195,312 | 195,312 | 195,312 |
| 12 - Participation Payments | | | |
| 13 = Total Gain | 159,532 | 115,176 | 80,678 |
| 14 - Excess Cost Recovery (Line 8) | 416 | 416 | 416 |
| 15 - Suspended Losses | | | |
| 16 = Gain or (Loss) | 159,116 | 114,761 | 80,262 |
| 17 - Straight Line Cost Recovery (limited to gain) | 24,491 | 24,491 | 24,491 |
| 18 = Capital Gain from Appreciation | 134,625 | 90,270 | 55,771 |
| ITEMS TAXED AS ORDINARY INCOME: | | | |
| 19 Excess Cost Recovery (Line 8) | 416 | 416 | 416 |
| 20 - Unamortized Loan Points | 1,027 | 1,027 | 1,027 |
| 21 = Ordinary Taxable Income | (611) | (611) | (611) |
| CALCULATION OF SALES PROCEEDS AFTER TAX: | | | |
| 22 Sale Price | 377,494 | 330,307 | 293,606 |
| 23 - Cost of Sale | 22,650 | 19,818 | 17,616 |
| 24 - Participation Payments | | | |
| 25 - Mortgage Balance(s) | 140,835 | 140,835 | 140,835 |
| 26 = Sale Proceeds Before Tax | 214,010 | 169,654 | 135,156 |
| 27 - Tax (Savings) : Ordinary Income at 27% ( Line 21) | (165) | (165) | (165) |
| 28 - Tax : Straight Line Recapture at 25% (Line 17) | 6,123 | 6,123 | 6,123 |
| 29 - Tax on Capital Gains at 20% (Line 18) | 26,925 | 18,054 | 11,154 |
| 30 = SALE PROCEEDS AFTER TAX | 181,127 | 145,643 | 118,044 |

INTERNAL RATES OF RETURN

**BEFORE TAX**

| Alternative 1 n | $ | Alternative 2 n | $ | Alternative 3 n | $ |
|---|---|---|---|---|---|
| 0 | (67,759) | 0 | (67,759) | 0 | (67,759) |
| 1 | 2,854 | 1 | 2,854 | 1 | 2,854 |
| 2 | 4,101 | 2 | 4,101 | 2 | 4,101 |
| 3 | 5,425 | 3 | 5,425 | 3 | 5,425 |
| 4 | 6,828 | 4 | 6,828 | 4 | 6,828 |
| 5 | 8,315 + 214,010 | 5 | 8,315 + 169,654 | 5 | 8,315 + 135,156 |
| IRR= | 30.7% | IRR= | 25.4% | IRR= | 20.6% |
| NPV= | $0 | NPV= | $0 | NPV= | $0 |
| @ | 31% | @ | 25% | @ | 21% |

**AFTER TAX**

| Alternative 1 n | $ | Alternative 2 n | $ | Alternative 3 n | $ |
|---|---|---|---|---|---|
| 0 | (67,759) | 0 | (67,759) | 0 | (67,759) |
| 1 | 4,161 | 1 | 4,161 | 1 | 4,161 |
| 2 | 5,004 | 2 | 5,004 | 2 | 5,004 |
| 3 | 5,898 | 3 | 5,898 | 3 | 5,898 |
| 4 | 6,846 | 4 | 6,846 | 4 | 6,846 |
| 5 | 7,850 + 194,854 | 5 | 7,850 + 159,369 | 5 | 7,850 + 131,770 |
| IRR= | 29.18% | IRR= | 24.75% | IRR= | 20.78% |
| NPV= | $0 | NPV= | $0 | NPV= | $0 |
| @ | 29.2% | @ | 24.8% | @ | 20.8% |

Cap rate used on Sale = 7.% | Cap rate on Sale = 8.% | Cap rate on Sale = 9.%

INTERNAL RATES OF RETURN

## Downside Sensitivity Analysis

| ASSUMPTIONS | Basecase | Scenario 1 | Scenario 2 |
|---|---|---|---|
| **Vacancy Rate** | 5.0% | 10.0% | 15.0% |
| **Energy Escalation** | 3.0% | 10.0% | 15.0% |
| **Rent Escalation** | 5.0% | 3.0% | 2.0% |
| **Expenses Escalation** | 3.0% | 5.0% | 7.0% |
| **Sales Price** | 8% CAP | 9% CAP | 10% CAP |
| **NPV (after-tax), d=10%** | | | |
| | Basecase | Scenario 1 | Scenario 2 |
| **Vacancy Rate** | 49,906 | 28,572 | 7,237 |
| **Energy Escalation** | 49,906 | 47,608 | 45,777 |
| **Rent Escalation** | 49,906 | 18,259 | 3,276 |
| **Expenses Escalation** | 49,906 | 32,593 | 14,010 |
| **Sales Price** | 49,906 | 30,433 | 14,854 |
| **ROA Year-5 (pre-tax)** | | | |
| | Basecase | Scenario 1 | Scenario 2 |
| **Vacancy Rate** | 11.3% | 10.3% | 9.2% |
| **Energy Escalation** | 11.3% | 10.4% | 9.6% |
| **Rent Escalation** | 11.3% | 9.8% | 9.1% |
| **Expenses Escalation** | 11.3% | 10.5% | 9.7% |
| **Sales Price** | | N/A | N/A |
| **IRR (after-tax)** | | | |
| | Basecase | Scenario 1 | Scenario 2 |
| **Vacancy Rate** | 21.9% | 17.3% | 12.0% |
| **Energy Escalation** | 21.9% | 21.4% | 21.0% |
| **Rent Escalation** | 21.9% | 15.1% | 11.0% |
| **Expenses Escalation** | 21.9% | 18.4% | 14.0% |
| **Sales Price** | 21.9% | 18.0% | 14.3% |
| **Cash Flow After Taxes, Year-5** | | | |
| | Basecase | Scenario 1 | Scenario 2 |
| **Vacancy Rate** | 7,850 | 6,204 | 4,557 |
| **Energy Escalation** | 7,850 | 6,416 | 5,210 |
| **Rent Escalation** | 7,850 | 5,498 | 4,373 |
| **Expenses Escalation** | 7,850 | 6,347 | 4,756 |
| **Sales Price** | | N/A | N/A |